DETAILED ACTION

Election without Traverse

1. **Claims 15-18** are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on March 16th, 2010.

Status

2. Claims 1-18, filed as a preliminary amendment on November 7th, 2006, are pending. Claims 15-18 are withdrawn.

Priority

3. Applicants' claim to foreign priority of United Kingdom patent 0407539.6, filed April 2nd, 2004 has been recorded.

Information Disclosure Statement

4. The information disclosure statement (IDS) submitted November 1st, 2006 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered by the examiner. Please refer to applicants' copy of the 1449 form submitted herewith.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. **Claims 1-14** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, the preamble recites: "a method of making high density (>7.0g/ml) sintered…" however it is not clear whether the part produced at the end of step (ii) is limited to a density of > 7.0 g/ml or not. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c).

Additionally, if Applicants seek to limit claim 1 to producing parts of density > 7.0 g/ml, claim 11 then must be objected to for failure to further limit the parent claim's required density range.

For the purposes of examination, the preamble is considered to not limit the claimed method to producing final parts of > 7.0 g/ml.

Furthermore, claim 1 recites in step (i) "with a conventional iron powder" however it is unclear from the specification which iron powders Applicants intends to cover by this recitation (see MPEP 2173.05(b)). The Examiner suggests deleting the word "conventional" to leave "…an iron powder or iron alloy powder…".

Regarding claims 2 and 3, both claims recite "…added to the mix in conventional amounts as used in powder metallurgy technology…" however, again, it is unclear from the specification what graphite and lubricant contents Applicants intends to cover by

these recitations (see MPEP 2173.05(b)). The Examiner suggests deleting the word "conventional" in both cases.

Claims dependent on any of the above are likewise rejected under this statute.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Joint Inventors

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. **Claims 1-4, 7-12, and 14** rejected under 35 U.S.C. 103(a) as being unpatentable over any one of **Sugano** (JP 61-186454 – Full human translation) or **Klar** (US 4,861,373).

Regarding claims 1 and 8, Sugano discloses (p. 9) mixing Fe powder and Fe-alloy powders with Fe-B (ferroboron master alloy) powder having a particle size of less than 100 mesh (less than 149 microns, thus an overlapping range of particle size), followed by pressing and sintering (p. 9-10) to produce an increased density part.

Sugano does not explicitly disclose that < 6 wt% of master alloy is used, that the mean particle size of the master alloy is 1 - 30 microns (1-20 microns for claim 8), or that the master alloy powder is atomised.

However, the amount of master alloy added is determined by the desired B content in the final sintered part and with a range of 0.02 – 1.2 wt% desired (p. 7), one of ordinary skill in the art would have arrived at the instantly claimed ranges through optimization. Similarly, Sugano discloses overlapping particle sizes for the boron-containing master alloy.

Thus, it would have been obvious to one of ordinary skill in powder metallurgy, at the time of the invention, to select any portion of the claimed ranges of master alloy content and particle size, including the claimed ranges, from the overlapping ranges disclosed in Sugano because Sugano finds that the prior art process in the entire disclosed ranges has a suitable utility and the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages and in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive

to discover the optimum or workable ranges by routine experimentation (MPEP 2144.05, section I, para 1 and section II, A, para 1).

With respect to the particles being “atomised" this is not considered to impart any particular structure to the claimed master alloy in the absence of evidence in the instant specification or the prior art.

Klar discloses (col. 5, lines 25-38) a process of mixing iron powder with a master alloy powder of ferroboron having a boron content of 3.8 wt% and particle size of less than 270 mesh (less than about 53 microns), followed by compacting and sintering. The master alloy is added in an amount sufficient to produce a final boron content in the sintered part of 0.02 wt%.

Just as with Sugano, Klar does not explicitly disclose that < 6 wt% of master alloy is used, that the mean particle size of the master alloy is 1 - 30 microns (1-20 microns for claim 8), or that the master alloy powder is atomised.

However, the <6 wt% and particle size limitations would have been obvious to one of ordinary skill in powder metallurgy for the same reasons as stated for Sugano above.

Regarding claims 2-4, both Sugano (p. 9) and Klar (col. 5, lines 25-30) disclose adding graphite powder and solid lubricants. The amounts added as considered to be “conventional amounts”.

Regarding claim 7, Sugano’s master alloy powder has a B content of 20 wt% (p. 9) while Klar’s master alloy powder has a B content of 3.8 wt% (col. 5, lines 25-31).

Regarding claims 9-11, Sugano discloses (p. 9 and 10) sintering in a vacuum at a temperature of 1140 - 1250°C, while Klar discloses (col. 5, lines 25-37) sintering in a vacuum at 2050 (about 1121°C).

Regarding claim 12, although neither Sugano nor Klar explicitly state that their pressing steps are performed cold, neither references states that they are performed at elevated temperature, thus both references are considered to implicitly disclose cold pressing.

Regarding claim 14, Sugano does not disclose the green density of his compacted powders however one of ordinary skill in the powder metallurgy would have reasonably expected that Sugano's compacts to have green densities in the claimed range as the Sugano performs a substantially similar mixing, pressing, and sintering process on substantially similar Fe powders and the final densities (Table 1) are within the same range that Applicants achieve (i.e. claim 18).

Klar discloses that his powder mixes were compacted to a green density of about 7 g/cc (col. 5, lines 25-38).

7. **Claims 5 and 6** are rejected under 35 U.S.C. 103(a) as being unpatentable over any one of **Sugano** or **Klar** in further view of **Johnson** (US 5,330,792).

The disclosures of Sugano and Klar were discussed in section 6 above, however none of the three references disclosed liquid lubricants or dissolved solid lubricants

Regarding claims 5 and 6, Johnson discloses a method of incorporating a combined lubricant and sintering aid into a powder metallurgical composition of iron-

based powders (col. 2. lines 10-15) comprising combining an organic solution of a metal salt of a fatty acid such as stearic acid (col. 2, lines 30-32) with the iron powders (col. 2, lines 16-24).

Johnson's method has the advantage of forming a powder composition with a uniform coating of lubricant, resulting in enhanced lubrication properties upon compaction and enhanced properties after sintering (col. 2, lines 34-45). Use of Johnson's lubricant solution achieved greater green density, sintered density, and transverse rupture strength when compared to controls using only solid acrawax or solid copper stearate.

It would have been obvious to one of ordinary skill in powder metallurgy, at the time of the invention, to have mixed the powders of any one of Sugano or Klar with the lubricant solution of Johnson to achieve the improved green and final sintered product properties as demonstrated by Johnson.

Johnson's lubricant solution is considered to read on "a liquid" as well as "a solid dissolved in a liquid" as the liquid is the solution and the solid dissolved in the fatty acid dissolved in an organic solvent.

8. **Claim 13** is rejected under 35 U.S.C. 103(a) as being unpatentable over any one of **Sugano** or **Klar**, as applied to claims 1-4, 7-12, and 14 above, in further view of **Hanejko** (F.G. Hanejko, "Warm Compaction", in *ASM Handbook,* Vol. 7, copyright 1998, 17 total pages.).

The disclosures of Sugano and Klar were discussed in section 6 above, however neither reference discloses warm pressing.

Regarding claim 13, Hanejko discloses (p. 3 and 6) that warm compacting at a temperature of about 130 – 150 °C (typical temperatures – p. 15) yields a 0.10 – 0.25 g/cm3 improvement in green density (p. 3). Furthermore, warm compaction has several advantages over cold pressing including better compressibility and higher green strength (p. 15).

Thus, it would have been obvious to one of ordinary skill in powder metallurgy, at the time of the invention, to have modified the pressing and sintering processes of either of Sugano or Klar to perform warm pressing at a temperature of 130 – 150 °C instead of cold pressing to achieve the benefits described by Hanejko in terms of improved compressibility, green strength, and green density.

Conclusion

-- Claims 1-14 (All elected) are rejected
-- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the text of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588 and fax number is (571) 270-4588. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark L. Shevin/

June 4th, 2010
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/George Wyszomierski/
Primary Examiner
Art Unit 1793